Diagnosing And Repairing Wheel Vibration

BY PAUL WEISSLER
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At long last it's the weekend and you're headed for the mountains--or the desert --or the shore. Anywhere out of town. And for the first time in weeks you can point your hood ornament at the horizon instead of the license plate in front of you and actually achieve the speed limit on the interstate. Your hands shake with glee.

Actually, that's not glee, or even healthy anticipation. Nor is it some unspeakable neurological syndrome. It's a vibration that isn't even perceptible at lower speeds.


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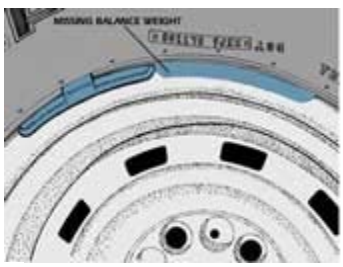
Maintain Your Balance
A simple wheel balance will cure most vibrations. But if that doesn't cure the problem--or if it cropped up suddenly within a reasonable time after a wheel balance--your problems may go deeper.


CLICK TO ENLARGE
Missing wheel weights will leave marks on the rim. Check the inside of the rim, too.

Begin by cranking the wheels over to the steering stop and looking at the inside of the rim. It's customary to split the amount of the balance weights between the inside and outside of the rim. If a weight (even an old one) has come off, that could be the problem. The weight should leave a clear outline, so you'll know exactly how much is missing. If the balance weight was added recently, you can take it back to the shop for a replacement.

Also inspect the rim--inside and outside--for any damage. Look for packed mud on the inside of the wheel. Also look at the tires--if you see any bulges or uneven wear of the tires, consider them in the "probable cause" category.

Nothing obvious? Take the car for a test drive. When the vibration occurs, is it while you're accelerating through a bend? That means it's both torque and speed sensitive. When you pull back to your garage, inspect the axle shafts, looking for damage to the boots. Constant velocity joints can wear out. But if the boots are intact, the clamps are holding them at each end, and there's been no loss of lubricant and no intrusion of road film, then they're probably in good condition.

If the vibration is not related to torque, shift into Neutral and let the vehicle coast at the problem speed. Still have the vibration? It's speed sensitive pure and simple. This could be the source of your troubles, even if the wheels are balanced and the tires are good. It's not a powertrain or driveline issue.

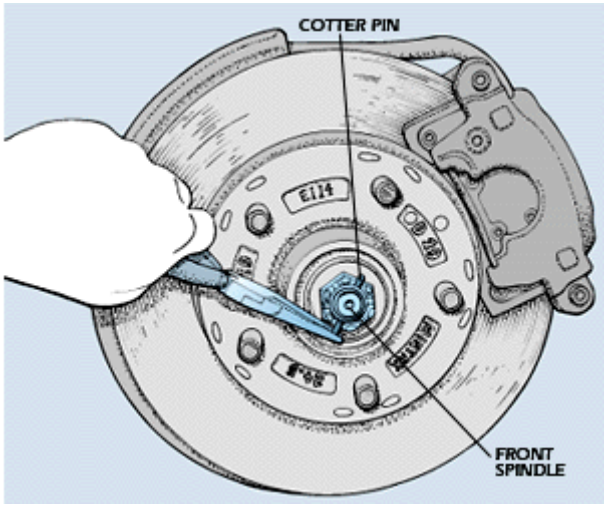
Keeping Your Bearings

Jack up the front wheels by the control arms, so they're off the ground, and support them with safety stands. Grasp each wheel, holding it first at the sides, then at the top and bottom. See if you can rock the wheel in and out and if you can feel any looseness, which indicates a loose wheel or worn wheel hub bearings. To replace wheel bearings on front-drive cars, you've got to remove the wheel hub. This job requires a slide-hammer puller, a tool typically available from the rental Peg-Board of many auto parts stores, and a torque wrench capable of the high torque usually required for the retaining nut (often well over 200 ft.-lb.). Front-drive wheel bearings (and the front bearings on many rear-drive cars) are well-sealed and often are life-of-the-car without lubrication. However, if you've been on a lot of secondary roads, or glanced off a curb hard enough to bend a rim, they could be worn or damaged.

If you have a rear-drive car it probably has adjustable front wheel bearings, and finding a lot of free play in these is not surprising. To adjust, remove the cotter pin, tighten the wheel bearing nut to about 20 ft.-lb. to seat the bearings, and back off so they're just free but have so little play that you really can't feel it. Then line up the slot in the spindle with the nut and insert a new cotter pin.

Steering Your Way

You may not feel free play in a front wheel (front- or rear-drive), but try rocking it in and out with a bit more effort, but not enough to move the steering linkage. That could demonstrate free play from wear in the tie-rod ends or ball joints. If you're not sure where the free play is, pry up on the bottom of the tire and watch the ball joint to see if it has free play1/4 in. is a lot.



Remove the cotter pin to retorque a loose front wheel bearing on a rear-drive car.

To check a tie-rod end joint for looseness, try to flex it by hand. A good tie-rod end should feel snug, but not immobile or stiff.

On rack-and-pinion steering, it's a good idea to check the tie rods' inner sockets. They're covered by the steering rack boots, but you can squeeze the boots to hold the inner joint. Jack up the front end to take the weight off the front wheels. Have a friend slowly turn the steering wheel a partial turn to each side, while you feel for looseness.

Look Out For Runout

Just because you can't feel a lot of free play or "wobble" in

a wheel doesn't mean there isn't enough to cause vibration. It doesn't take a lot to be responsible for objectionable vibration at speeds of 60 to 70 mph and aboveany deviation from a truly circular spin is called runout. It can be vertical (up-down) or horizontal (in-out).

The only practical way to check for runoutfront or rearis with a dial indicator, another tool you can rent at many parts stores. There are several different checks to make to pinpoint the source of the runout.

Mount the indicator on something heavy that won't move, such as an anchor plate or wheel hub/knuckle. Position the plunger for the specific runout check. Example: For a radial runout test, rest it against a good tire tread groove. Slowly turn the tire and measure the amount of runout, ignoring jumps in the plunger that result from the shape of the tread or minor imperfections in it. If there are factory specifications for runout, use those.

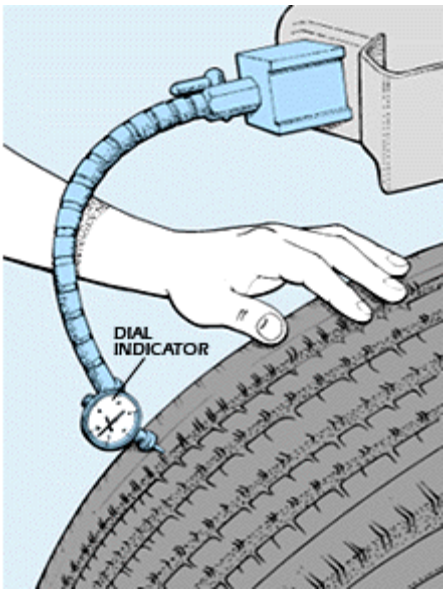
If you don't have specs, see if the runout is about .050 to .060 in.this measurement is considered rule of thumb. The tire almost surely isn't the issue, although there is precision equipment that can check a tire for heavy spots. We knowyou don't have it and can't rent it. Most professionals don't have it either, which tells you how common it is.

To isolate the source of the runout, check it at the wheel with the plunger on an underside horizontal surface. Ignore minor imperfections in the wheel finish (paint, weld, tiny dings) that cause the plunger to jump instantaneously. If the runout is over .045 in., the wheel should be replaced.

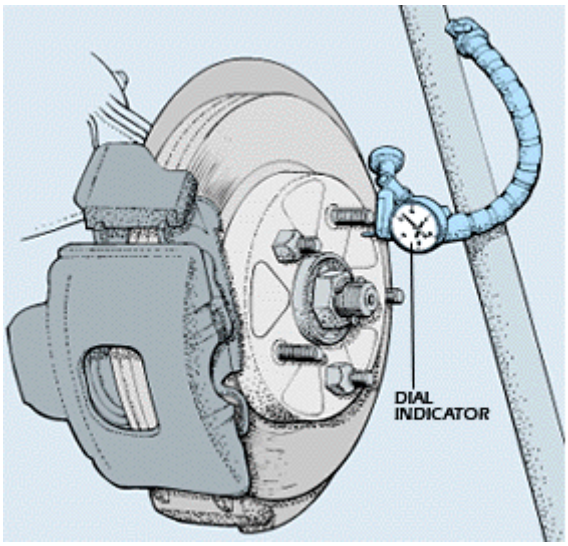
If radial runout isn't bad, check lateral runout with the plunger against the sidewall, even if the in-out rocking didn't show anything. Obviously, ignore any plunger movement from raised lettering, etc. If the runout is over .045 in., it's too much. Here again, isolate the runout by checking at the wheel with the plunger against a vertical surface. The rule-of-thumb specs are the same as for radial runout.

When the runout at the wheel is excessive, a new wheel normally is the answer, but not always. Remove the wheel and check runout on the wheel hub. Making a lateral runout check is an obvious procedure because there's a hub face against which you can rest the plunger.

For a radial check, it may be more difficult if the top surface of the hub isn't reasonably smooth because you



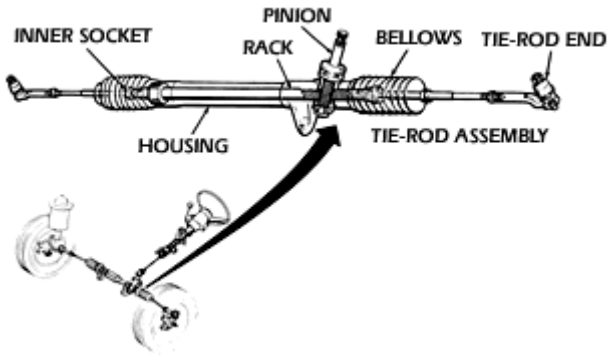
Total radial runout at the tire tread should be no more than .050 to .060 in.



If radial or lateral runout is high, check both runouts at the hub to rule out a bent rim.

have to use the threaded edges of the studs, and, typically, there are only four or five of those studs. So it does take some careful measuring to see if there's a significant amount. You have to look for the peak reading at each stud to be sure you're measuring at the outermost point. Unless almost all the radial runout is in the bolt circle, and that amount is at least .030 in., go for a new wheel. Replacing the hub and bearing on a front-drive is not a quick and easy job.

It can take a couple of hours to check out the possible causes of high-speed vibration, and you may be tempted to take the car in for wheel alignment to see if that helps before you spend time on all these other things. Sorry. Unless there's some evidence of wheel misalignment (such as irregular tire wear), a wheel alignment is not going to help at all. In fact, until you first isolate and correct the cause of the vibration, alignment would be a waste of time and money.



HOW IT WORKS:

Rack-And-Pinion Steering

There are several types of steering systems, but the rack- and-pinion has become the most popular because of its simplicity and precise response. It's used primarily on passenger cars and is even being designed to fit into some sport utility vehicles. The rack is a shaft with gear teeth, and it meshes with the pinion, a gear at the end of the steering wheel shaft. The rack is horizontally installed between the front wheels and is connected by a tie rod at each side to a steering knuckle, the pivoting structure to which each front wheel is attached. The tie rod has a flex joint at each end that allows it to flex and pivot in transferring steering wheel motion from the rack to the knuckles. As the steering wheel is turned to either side, the pinion rotates and moves the rack to that side, pivoting the front wheels in the same direction.

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